NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

July 19, 2011

Cockpit Display(s) – Recorded Flight Data

Specialist's Factual Report
By
Michael Bauer

1 EVENT SUMMARY

Location: Waxahachie, TX
Date: January 23, 2010
Aircraft: Tecnam P2002 Sierra
Registration: N145AG
NTSB Number: CEN10FA107

On January 23, 2010, a Tecnam P2002 Sierra special light sport airplane, N145AG, was substantially damaged when it impacted terrain following an uncontrolled descent near Waxahachie, Texas. The flight instructor and student pilot sustained fatal injuries. The airplane was owned by U S Aviation Group, LLC, Denton, Texas and was operated by CRP Future Pilots Flight School, Inc., Dallas, Texas. Visual meteorological conditions prevailed at the time of the accident and a flight plan had not been filed for the Title 14 Code of Federal Regulations Part 91 instructional flight. The flight departed the Dallas Executive Airport (RBD).

2 COCKPIT DISPLAY GROUP

A cockpit display(s) group was not convened.

3 DETAILS OF COCKPIT DISPLAY RECORDER INVESTIGATION

On February 17, 2010, the Safety Board's Vehicle Recorder Division received the following cockpit display(s):

Device Manufacturer/Model: **Advanced Flight Systems AF-3400EF**
Device Serial Number: **60589**

Device Manufacturer/Model: **TruTrak DigiFlight II Series Autopilot**
Device Serial Number: **Unknown**

Device Manufacturer/Model: **WxWorx Portable Receiver**
Device Serial Number: **0G48018Z**

3.1 Advanced Flight Systems AF-3400EF Description

The AF-3400EF is an 6.5 inch cockpit display capable of displaying Electronic Flight Instrument System (EFIS) information to the pilot. The unit contains a Crossbow Attitude/Heading Reference System, AHRS to provide the pilot with attitude and heading information. The unit also contains an internal Air Data System, ADS, to provide the pilot with altitude and airspeed information. The unit can also display engine data if it is connected to an Advanced Flight Systems display that contains an engine monitor board. The unit is customizable to the individual aircraft installation. The unit also has the capability to store flight data internally on a surface mounted Flash TSOP[1] memory chip. The pilot configures the unit to store parameters that are available in the system and based on the aircraft configuration, i.e. cylinder head temperatures for 4 cylinders. The pilot also can configure the recording interval; the default is one sample every five seconds. The fastest sample rate is one sample per second. In a working unit data can be downloaded using the selections on the maintenance pages, to a SD[2] card.

The LCD display was seperated and damaged from the unit in the accident, see Figure 1. Safety Board staff disassembled the unit and removed the circuit card from the display which contains one surface mounted Flash TSOP memory chip. The memory chip was visually inspected and then removed from the circuit card. With assistance from Advanced Flight Systems, the memory chip information was recovered and decoded.

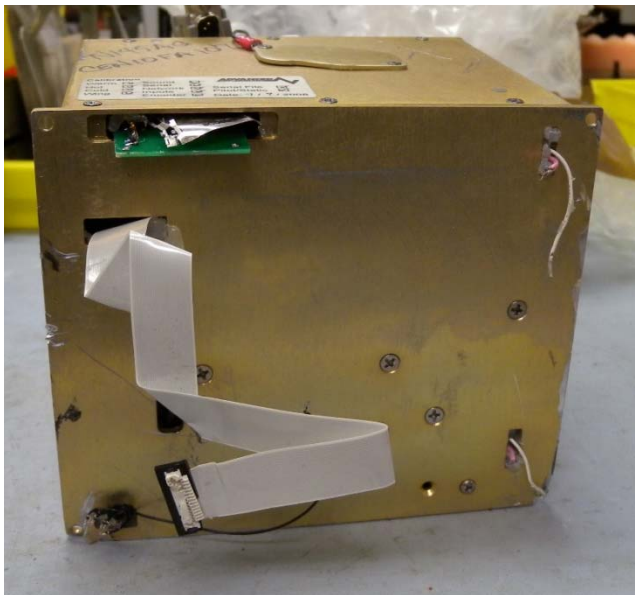


Figure 1 - Front view of damaged AFS-3400

The SD card was also damaged in the accident and ejected from the unit. The SD card was inspected and the card was damaged beyond repair, see Figure 2. No data could be recovered from the SD card.

[1] Thin Small Outline Package – A type of surface mount design for integrated circuit devices
[2] SD – Secure Digital is a non-volatile memory card for use in portable devices

Figure 2 - Recovered SD card from EFIS display showing damage.

3.2 TruTrak DigiFlight II Series Autopilot Description

The TruTrak DigiFlight II series autopilot is a panel mounted instrument which can provide directional control for the aircraft. The autopilot uses gyroscopic rate senors to sense motion about each of the major axes (roll, yaw and pitch). The autopilot is also connected to the aircraft's pitot-static system and a GPS system. The instrument is connected to installed servos which will control aircraft motion around an axis when the autopilot is active. The unit does not record any data.

3.3 WxWorx Portable Receiver Description

The WxWorx portable receiver decodes transmissions from XM WX Satellite Weather. The decoded data is then transmitted to a display unit (i.e multi-function display or laptop computer). The unit does not record any data.

3.4 Recording Description

The AF-3400 recording contained approximately 14 hours of data over 20 power cycles. The accident flight was the last flight of the recording and its duration was approximately 25 minutes.

3.5 Time Correlation

The AF-3400 records time with the first data sample based on the units' internal clock. This clock is set and updated by the operator. Typically when the unit is powered up to download the data, the displayed time is recorded and compared to the local time at power up. Due to the condition of the unit, a power up time comparison could not be accomplished.

Correlation of the AF-3400 data from the recorded time to the accident local time was established using radar data supplied by the Investigator In Charge. The accident flight data has been offset from the recorded radar data time[3] to the accident time by subtracting 3,253 seconds.

3.6 Engineering Units Conversions

The engineering units conversions used for the data contained in this report are based on information from the manufacturer of the AF-3400. Where applicable, changes to the conversions have been made to ensure the parameters conform to the Safety Board's standard sign convention that climbing right turns are positive (CRT=+).[4]

3.6.1 Parameters Provided and Verified

The following table lists the parameters provided and verified in this report, including the associated plot label.

Table 1 - Verified and Provided Parameters

Plot Label	Parameter
1. Accel Lat (g)	Lateral Acceleration (g)
2. Accel Vert (g)	Vertical Acceleration (g)
3. Airspeed (kts)	Computed Airspeed (knots)
4. Altitude Press (ft)	Pressure Altitude (feet)
5. Ground Spd (kts)	Ground Speed (knots)
6. Heading (deg)	Magnetic Heading (degrees)
7. Latitude (deg)	Latitude (degrees) [5]
8. Longitude (deg)	Longitude (degrees)[5]
9. Pitch (deg)	Pitch Angle (degrees)
10. Roll (deg)	Roll Angle (degrees)
11. Temp OAT (degF)	Outside Air Temperature (degrees Fahrenheit)
12. Vertical Spd (fpm)	Vertical Speed (feet per minute)
13. Time Day	Calendar Day[5]
14. Time Month	Calendar Month[5]
15. Time Year	Calendar Year[5]
16. Time Hour	Hours[5]
17. Time Min	Minutes[5]
18. Time Sec	Seconds[5]

[3] The radar data was supplied in Coordinated Universal Time (UTC) and converted to Central Standard Time by subtracting 6 hours.

[4] CRT=+ means that for any parameter recorded that indicates a climb or a right turn, the sign for that value is positive. Also, for any parameter recorded that indicates an action or deflection, if it induces a climb or right turn, the value is positive. Examples: Right Roll = +, Left Aileron Trailing Edge Down = -, Right Aileron Trailing Edge Up = +, Pitch Up = +, Elevator Trailing Edge Up = +.

[5] Parameter included in tabular data only

3.7 Plots and Corresponding Tabular Data

The following four plots contain data recorded during the January 23, 2010 event and table 1 lists all of the parameters plotted.

Plots one and two contain basic parameters from the AF-3400 for the accident flight. Plot one contains the accident flight from take-off to the end of the recorded data. Plot two contains data from the final five minutes of the recorded data. All flight data in the AF-3400 was recorded at a rate of 1 sample every 5 seconds.

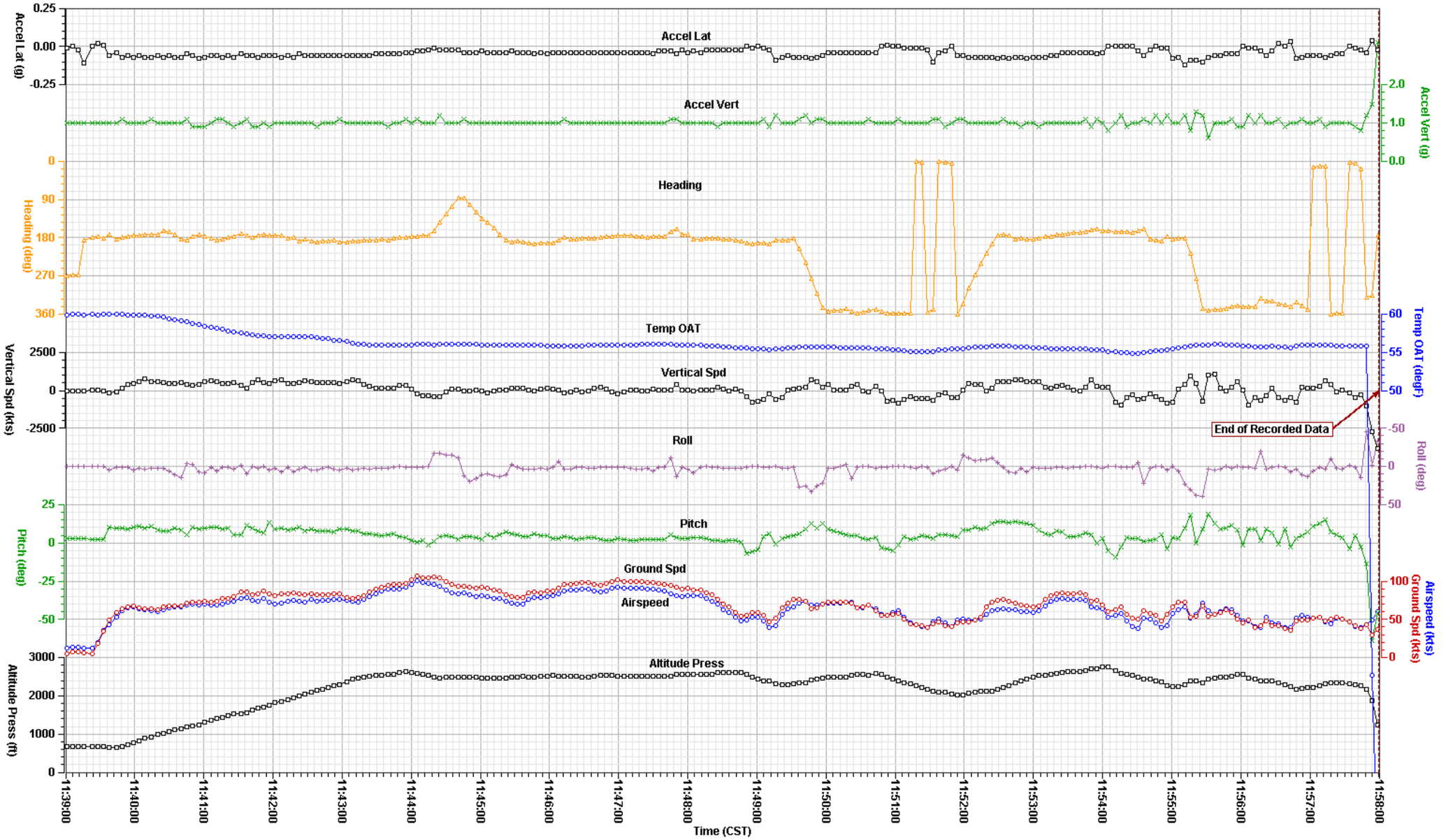
Plots three and four are Google Earth images of the recorded flight path. Plot three contains an overview of the entire flight path. Plot four contains the final minute of the recorded flight path.

The corresponding tabular data used to create these four plots are provided in electronic (.CSV) format as Attachment 1 to this report.

Tecnam P2002, N145AG

Location, Date: Waxahachie, TX, 01/23/10

NTSB No. CEN10FA107



Revised: 14 July 2011

Basic Parameters-Accident Flight

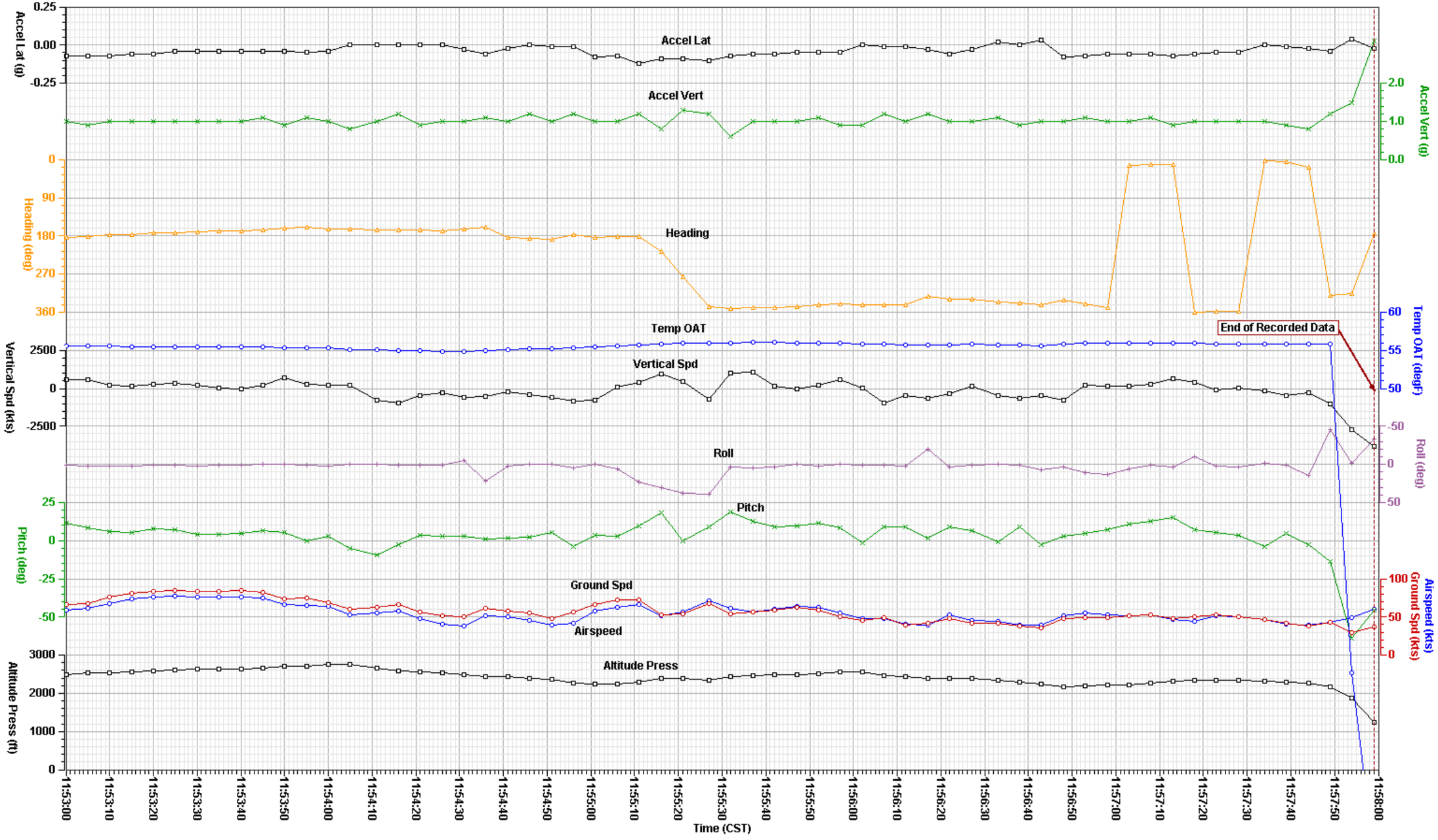
National Transportation Safety Board

Plot 1 - Basic parameters from the accident flight.

Tecnam P2002, N145AG

Location, Date: Waxahachie, TX, 01/23/10

NTSB No. CEN10FA107

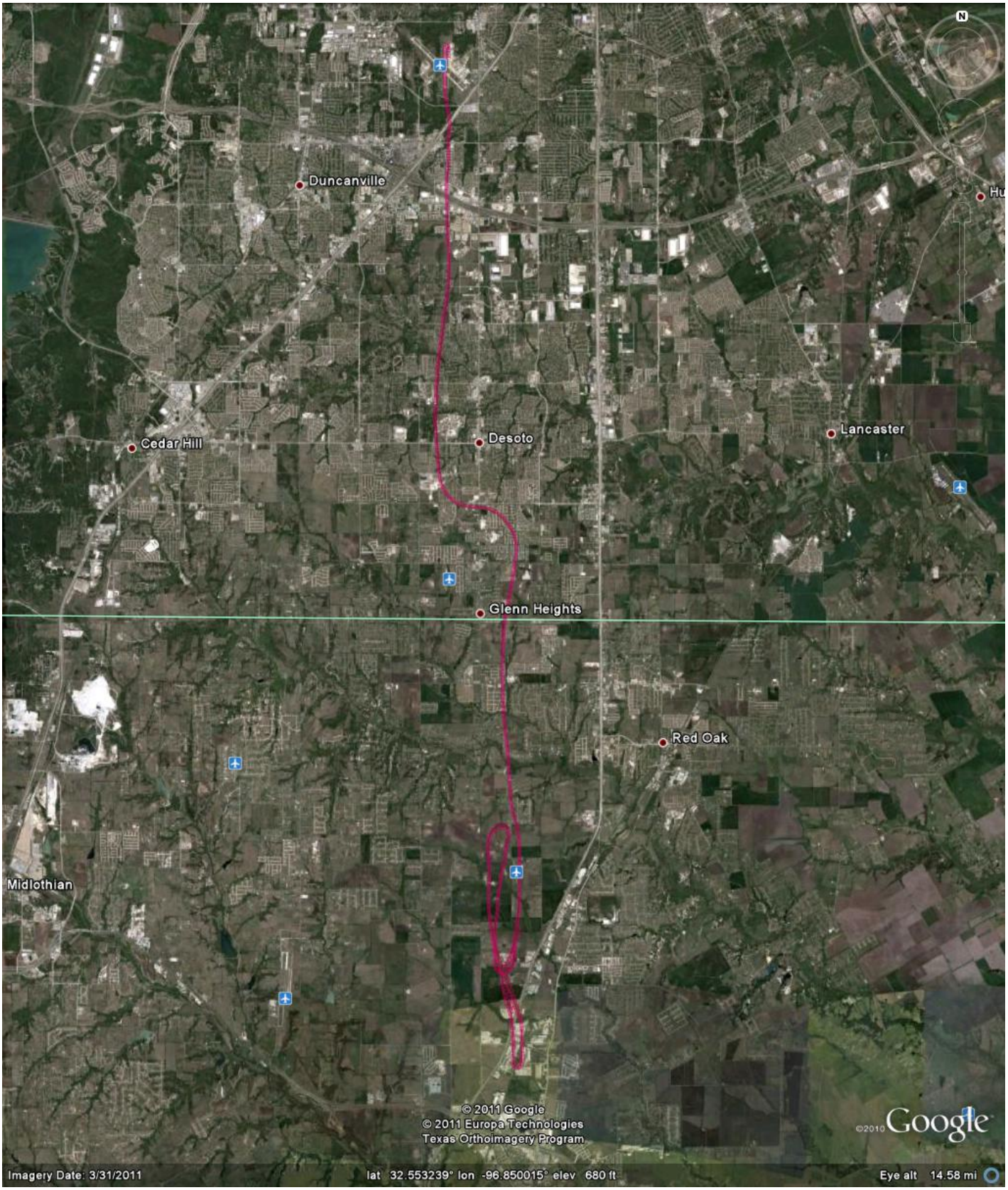


Revised: 14 July 2011

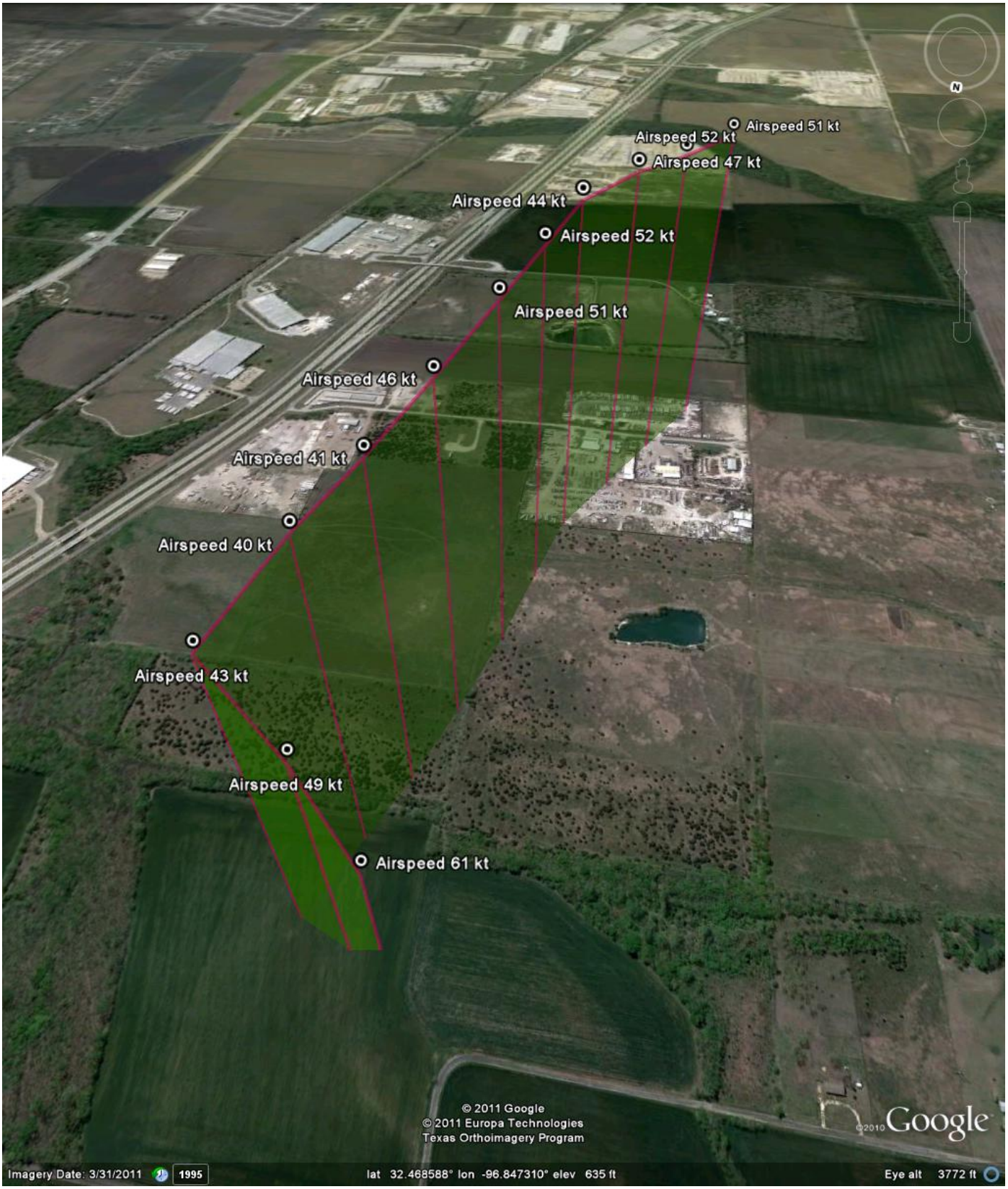
Basic Parameters-Accident Flight

National Transportation Safety Board

Plot 2 - Basic parameters from the final five minutes of recorded data.



Plot 3 - Flight path of N145AG



Plot 4 - Last minute of recorded flight path showing airspeed.